

WHAT IS CLAIMED IS:

1. An electron-emitting device comprising:

(A) fiber comprising carbon as a main ingredient,
and

5 (B) a layer made of oxide composed of a material
selected from Ti, Zr, Nb, and Al or a layer made of
oxide semiconductor composed of a material selected
from Ti, Zr, and Nb,

10 wherein the fiber comprising carbon as a main
ingredient is disposed on the layer and the fiber
comprising carbon as a main ingredient partially
contains Pd.

15 2. The electron-emitting device according to
claim 1, wherein the Pd is disposed at a position where
the fiber comprising carbon as a main ingredient is in
contact with the layer.

20 3. The electron-emitting device according to
claim 1, wherein the Pd is disposed on an end of the
fiber comprising carbon as a main ingredient or on an
intermediate point of the fiber comprising carbon as a
main ingredient.

25 4. The electron-emitting device according to
claim 1, wherein the fiber comprising carbon as a main
ingredient is grown via Pd particles disposed on the

layer.

5. The electron-emitting device according to
claim 1, wherein the fiber comprising carbon as a main
5 ingredient includes a graphen.

6. The electron-emitting device according to
claim 1, wherein the fiber comprising carbon as a main
ingredient includes a plurality of layered graphens.

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7. The electron-emitting device according to
claim 6, wherein the plurality of graphens is layered
in an axial direction of the fiber comprising carbon as
a main ingredient.

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8. The electron-emitting device according to
claim 1, wherein the fiber comprising carbon as a main
ingredient is made of graphite nanofiber, carbon
nanotube, amorphous carbon, or a mixture containing
20 more than one of these.

9. The electron-emitting device according to
claim 1, further comprising:

a first electrode on a surface of a substrate, and
25 a second electrode disposed on the surface of the
substrate and spaced apart from the first electrode,
means for applying a potential higher than the

first electrode to the second electrode,

wherein at least a part of the layer is disposed
on the first electrode.

5 10. The electron-emitting device according to
claim 9, wherein the first electrode is larger in
thickness than the second electrode.

10 11. The electron-emitting device according to
claim 9, wherein the fiber comprising carbon as a main
ingredient is disposed farther than the second
electrode from the surface of the substrate.

15 12. The electron-emitting device according to
claim 9, wherein the surface of the substrate has a
step height such that the first electrode is higher
than the second electrode.

20 13. An electron source comprising a plurality of
electron-emitting devices,

wherein the electron-emitting device is an
electron-emitting device according to any one of claims
1 to 12,

25 14. An image-forming apparatus comprising:
an electron source according to claim 13, and
an anode where an electron emitted from the

electron source comes into collision.

15. The image-forming apparatus according to claim 14, wherein the anode has a phosphor.

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16. An electron-emitting device comprising:

(A) first and second electrodes disposed with a gap on a surface of a substrate,

(B) a plurality of fibers each comprising carbon as a main ingredient electrically connected with the first electrode, and

(C) means for applying a voltage higher than the first electrode to the second electrode,

wherein ends of the plurality of fibers each comprising carbon as a main ingredient are higher than a surface of the second electrode from the surface of the substrate, and

a layer made of oxide composed of a material selected from Ti, Zr, Nb, and Al or a layer made of oxide semiconductor composed of a material selected from Ti, Zr, and Nb is disposed between the first electrode and the plurality of fibers each comprising carbon as a main ingredient.

17. The electron-emitting device according to claim 16, wherein the layer and the plurality of fibers each comprising carbon as a main ingredient are

connected to each other via a catalyst material.

18. The electron-emitting device according to
claim 17, wherein the catalyst material is a material
5 selected from Pd, Ni, Fe, Co, and an alloy of these.

19. The electron-emitting device according to
claim 16, wherein the first electrode is larger in
thickness than the second electrode.

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20. An electron source comprising a plurality of
arranged electron-emitting devices,

wherein the electron-emitting device is an
electron-emitting device according to any one of claims
15 16 to 19.

21. An image-forming apparatus comprising:
an electron source and
an image-forming member
20 wherein the electron source is an electron source
according to claim 20.

22. An electron-emitting device comprising:
(A) fiber comprising carbon as a main ingredient,
25 (B) a layer made of oxide composed of a material
selected from Ti, Zr, Nb, and Al or a layer made of
oxide semiconductor composed of a material selected

from Ti, Zr, and Nb,

wherein the fiber comprising carbon as a main ingredient is disposed on the layer, and

the fiber comprising carbon as a main ingredient
5 includes a plurality of layered graphens.

23. The electron-emitting device according to claim 22, wherein the plurality of graphens are layered in an axial direction of the fiber comprising carbon as
10 a main ingredient.

24. The electron-emitting device according to claim 22, wherein the fiber comprising carbon as a main ingredient is grown via Pd particles disposed on the
15 layer.

25. The electron-emitting device according to claim 22, wherein the fiber comprising carbon as a main ingredient contains Pd.
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26. An electron source comprising a plurality of electron-emitting devices,

wherein the electron-emitting device is an electron-emitting device according to any one of claims
25 22 to 25.

27. A method for manufacturing an image-forming

apparatus,

the apparatus comprising an electron source and an
image-forming member,

wherein the electron source is an electron source
according to claim 26.

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28. A method for manufacturing an electron-
emitting device, which includes fiber comprising carbon
as a main ingredient, comprising the steps of:

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(A) providing a layer made of oxide composed of a
material selected from Ti, Zr, Nb, and Al or a layer
made of oxide semiconductor composed of a material
selected from Ti, Zr, and Nb,

(B) disposing catalyst particles on the layer, and

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(C) heating the substrate on which the catalyst
particles are disposed in an atmosphere containing
carbon compound.

29. The method for manufacturing the electron-
emitting device according to claim 28, wherein the
carbon compound is hydrocarbon gas.

30. The method for manufacturing the electron-
emitting device according to claim 28, wherein the
layer is formed on the electrode disposed on the
substrate.

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31. The method for manufacturing the electron-emitting device according to claim 28, wherein the layer is formed by the step of forming a conductive layer made of a material selected from Ti, Zr, Nb, and Al on the substrate and oxidizing a surface of the conductive layer.

32. The method for manufacturing the electron-emitting device according to claim 31, wherein the step of oxidizing the surface of the conductive layer is carried out by the step of forming a material of the catalyst particles on the surface of the conductive layer and oxidizing the material.

33. The method for manufacturing the electron-emitting device according to claim 28, wherein the catalyst particles are made of a material selected from Pd, Ni, Fe, Co, and an alloy of these.

34. A method for manufacturing an electron-emitting device, which includes a plurality of electron-emitting devices,
wherein the electron-emitting device is manufactured by the manufacturing method according to any one of claims 28 to 33.

35. A method for manufacturing an image-forming

apparatus, which includes an electron source and an image-forming member,

wherein the electron source is manufactured by the manufacturing method according to claim 34.